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Reproductive Biology of the Regal Demoiselle *Neopomacentrus cyanomos* (Bleeker) 1856

G. Sreeraj[1] and G. Gopakumar[2]

[1]National Institute of Ocean Technology, Chennai. E-mail: gsreeraj@niot.res.in
[2]Vizhinjam Research Centre of Central Marine Fisheries Research Institute, Thiruvananthapuram – 695521. E-mail: ggopakumar@eth.net

Damselfishes belonging to the family Pomacentridae constitute one of the major groups of marine ornamental fishes. The present study investigate the gonadal maturation of the Regal demoiselle, *Neopomacentrus cyanomos* . Samples were collected from southwest coast of Kerala off Vizhinjam. The gonads were examined to determine the maturity stages. The smaller size group up to 65 mm standard length was all females at different stages of maturity. The size at first maturity of females was estimated to be 57 mm standard length. All the individuals above 80 mm were functional males with well developed testis. Female to male ratio in the entire sample was 4.6 :1. This points to the possibility of protogyny in the species. The average number of ripe eggs in the ovaries was 2780 ± 836. Ova diameter study of the ripening ovaries of *N. cyanomos* showed three distinct peaks and the ovaries contained eggs at different maturational stages. This indicates the continuous spawning nature in this species. However, ripe females were abundant during September to December and less abundant during April to June.

Introduction

Reproduction in reef fishes has always been a topic of interest to marine biologists the world over. Many reef fishes have adaptive mechanisms in reproduction to suit the peculiarities of the environment which they inhabit. A good number of fishes inhabiting these areas have attractive colour patterns and are of high demand in the aquarium trade. Family Pomacentridae, which includes clownfishes and damselfishes is an important group in this category. Most pomacentrids inhabit in areas of rich coral growth or rocky bottom and are highly territorial in nature. Studies on their reproductive biology can yield valuable information that will be useful in their captive broodstock development and breeding. Many pomacentrids are known to exhibit hermaphroditism. Pomacentridae includes gonochorists, with predetermination of sex, protogynous and protandrous hermaphrodites, and bisexual types in which the gonadal primordium bears both types of gonia[1]. Protandrous hermaphroditism in many species of anemonefishes[2,3,4,5,6,7] and the protogynous hermaphroditism in humbug damselfishes [8,9,10,11] are well documented. Another damselfish *Parma microlepis* is reported to be gonochoristic[12]. Information on the

sexuality of many fishes of this vast family is still not well known. The present account deals with the maturation pattern of the regal demoiselle, *Neopomacentrus cyanomos*.

Materials and methods

The samples were collected from Vizhinjam during November 1999 to May 2001. Samples were collected in all the months during the period. However, all the length groups could not be collected every month. A total of 327 specimens were collected during the period of study Standard length of all the specimens was taken to the nearest millimeter. The gonads were removed and were examined to determine the maturity stages. Size frequency data of males and females were prepared. The maturity stages of ova were determined as described by Schwarz and Smith (1990). The female gonads were classified into three as described by Qasim (1971) . They were (i) immature, (ii) maturing and (iii) ripening. Ovaries were considered immature when they contained stage I and stage II ova, maturing, when they contained stage III ova and ripening when stage IV and V ova were present. Four ripening ovaries collected in November 1999 and three maturing ovaries collected in May 2000 were used for taking ova diameter measurements. A small portion of the ovary was taken and all the eggs in that area were measured using an ocular micrometer through a monocular microscope. Since the eggs were capsule shaped, lengths of eggs were measured instead of diameter. Number of stage IV and stage V eggs present in the ovaries were counted using a stereomicroscope.

Results

The size frequency distribution of males and females of *N. cyanomos* is shown in Fig. 1. The smaller size groups up to 65 mm standard length were all females at different stages of maturity. All the individuals above 80 mm were functional males with well developed testis. The overlapping range of the two curves between 65 mm and 80 mm comprised of both males and females. Female to male ratio in the entire sample was 4.6 :1 and the same in the overlapping length range was 0.83 :1 . This points to the protogynous nature of the species.

Ripening ovaries predominated in the sample from July to February-March, but were fewer thereafter till June (Fig. 2). The ova diameter frequency polygon of maturing ovaries showed two distinct peaks corresponding to two major size groups of eggs (Fig. 3). Ripe eggs that were ready to be released were not found in the ovary. Ova diameter frequency polygon of ripening ovaries had three distinct peaks (Fig. 4). Immature eggs measured up to 12 divisions, maturing stage III eggs

measured 16 – 21 divisions and ripe eggs which were ready to be released measured more than 22 divisions. The average number of ripe eggs in the ovaries was 2779.6 ± 835.5. The size at first maturity of females was estimated to be 57 mm standard length (Fig. 5).

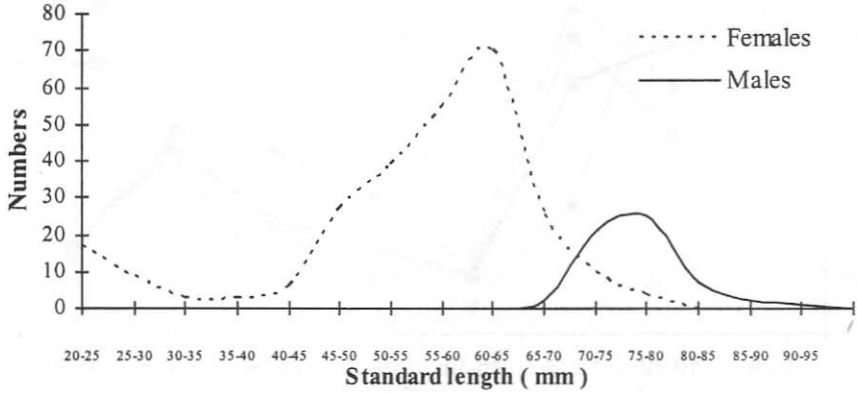


Figure 1: Size frequency distribution of males and females of *N. cyanomos*

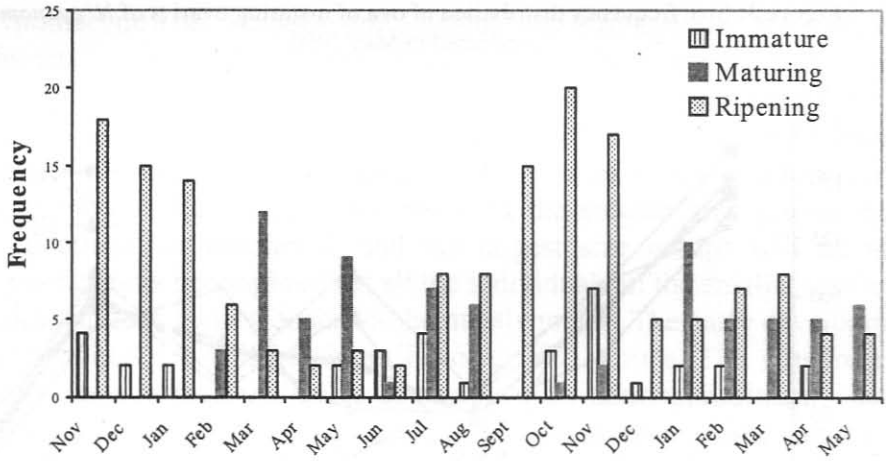
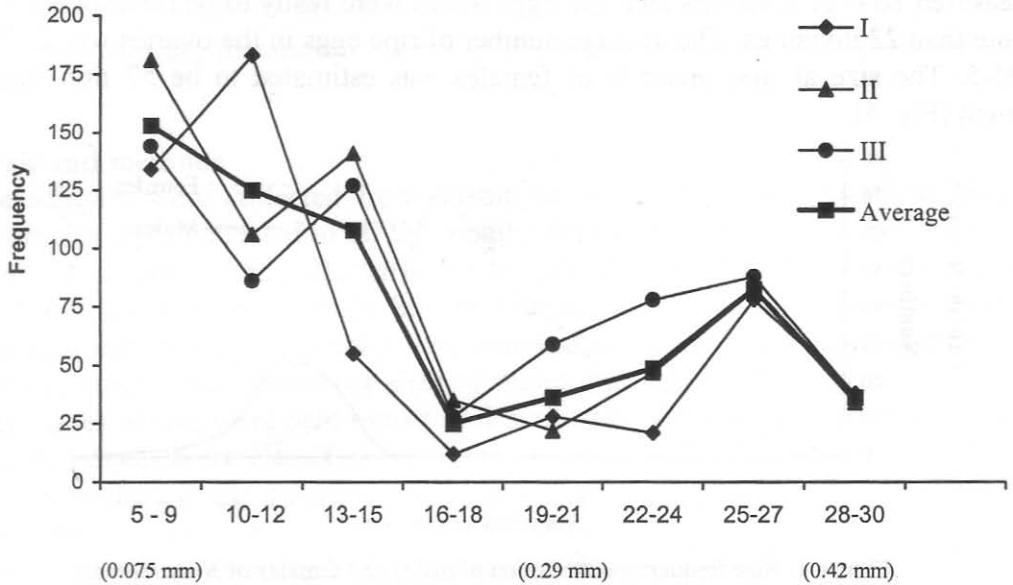
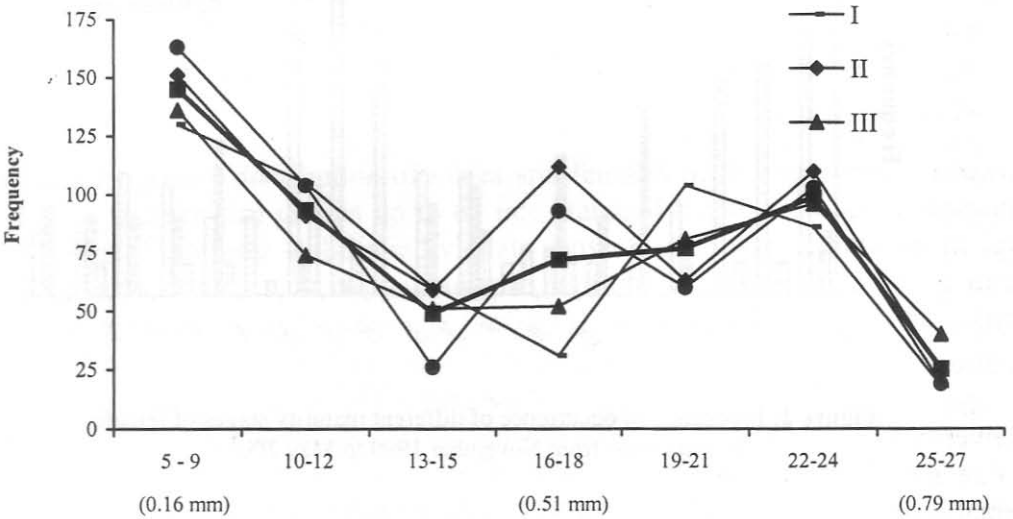


Figure 2: Frequency of occurrence of different maturity stages of female *N. cyanomos* from November 1999 to May 2001



Length of ova (In micrometer divisions; equivalent range in millimeter is given in parenthesis)

Figure 3: Size frequency distribution of ova of maturing ovaries of *N. cyanomos* collected in May 2000



Length of ova (In micrometer divisions; equivalent range in millimeter is given in parenthesis)

Figure 4: Size frequency distribution of ova of mature ovaries of *N. cyanomos* collected in November 1999

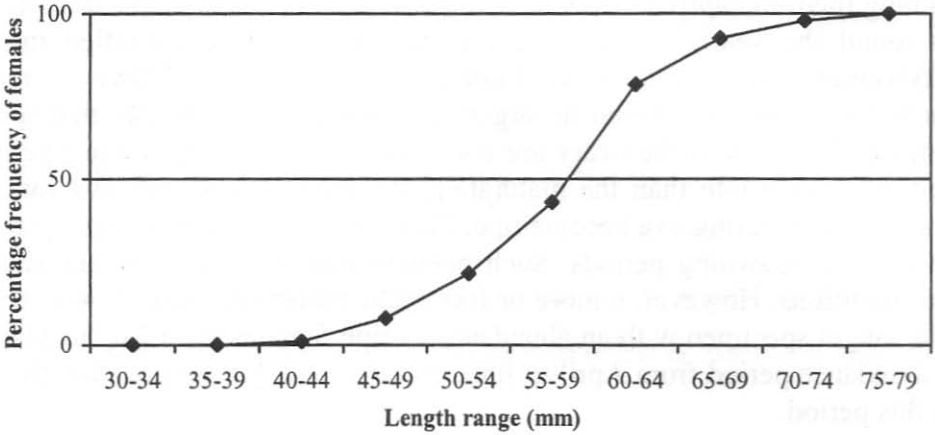


Figure 5: Cumulative frequency of mature females for different size groups in *N. cyanomos*

Discussion

Family pomacentridae includes protogynous and protandrous hermaphrodites and gonochorists[14]. Protandrous hermaphroditism has been reported from many species of anemone fishes and protogynous hermaphroditism is reported in some species of damselfishes. Size frequency distribution of both sexes of a population can be taken as one of the indicators to the direction and size of sexual transformation. In protandrous hermaphrodites all the individuals in the smaller size groups will be males, non functional or functional, and the largest size groups will be mostly females. In protogynous hermaphrodites all the individuals in the smaller size groups will be females and larger individuals will be mostly males. The early developmental stages of the terminal sex will be absent in lower size groups. The size frequency data of *N. cyanomos* is thus indicative of protogynous hermaphroditism. The high female to male ratio is a clear indication of polygynous mating system and the same was directly observed under captive conditions. Therefore the sex reversal may occur in a larger female in the group upon the loss of a functional male or with the addition of newer functional females. In protogynous *Dascyllus reticulatus,* all females above the size at first maturity are capable of changing sex, but the completion of the sex reversal is socially controlled [8]. Thus in *N. cyanomos* also all the mature females may be capable of transforming into males.

The species under study is a continuous breeder. This was observed directly by maintaining them in captivity. Also mature individuals of both sexes were collected almost round the year. Ovaries of continuous breeders are classified into three maturity stages[13]. Spent ovaries were not observed in sample. However, maturing ovaries were occasionally found in larger individuals. This indicates that spawning and maturation of ova in the ovary are continuous processes and when ripe ova are released at a faster rate than the maturation, the ovaries lack ripe ova for a short duration till the maturing ova become ripe. This can lead to small pauses in spawning after prolonged spawning periods. Such phenomenon was noted for the species in captive conditions. However, a more or less cyclic pattern of maturity was observed for wild caught specimen with an abundance of ripe females from July to March and a less abundance period from April to June. But ripe females were not totally lacking during this period.

The size frequency data of ova also point to the continuous breeding of the species. Ripening ovary contained maturing and immature eggs in large numbers. The maturing ovary contained only two sets of eggs and the largest group was in the maturing stage only. It may become similar to a ripening ovary as the maturation progresses and with the appearance of a new set of immature eggs at the beginning.

Biological as well as social aspects control the sexuality the species under study. The social organization and the behavior affect the sex ratio and sexual maturity. The information on the reproductive biology from the present study can thus form the basis for the development of broodstock and breeding of the species.

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